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AUTOMATED THEMATIC MAPPING AND CHANGE DETECTION OF ERTS-A IMAGES

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16. Abstract

This investigation is concerned with the development of automated interpretation techniques for the recognition and identification of earth resources. The resources will be identified by using both multispectral and spatial signatures. Ground truth data and aircraft underflight photography will be used to train the recognition algorithms. The data processed will be RBV and MSS images acquired by the ERTS-1 satellite, over six test sites located in the vicinities of: Phoenix, Arizona, Weslaco, Texas, Cascade Mountains, Washington, New Orleans, Louisiana, Salt Lake, Utah, and Salton Sea, California. The processed data will be thematic maps of resources consisting of annotated and outlined images. The seasonal changes of hydrologic and agricultural resources will also be identified. The results are expected to be applicable to a future automatic system of resource inventory and management.

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Discussion

During the reporting period, work continued with the analysis of ERTS-1 images. The first magnetic tapes that were compatible with our digital hardware (7-track, 556 BPI) were delivered on November 28, 1972. A program was written to unpack the data and separate the red band image from the rest of the spectral bands.

We are presently processing data from the Phoenix, Arizona test site. The unpacked red band images were recorded by the laser beam recorder to verify that the data was good and no errors were introduced by the unpacking operation.

The recorded images showed the data to be good, but the images were distorted. This is so, because the bulk processed CCTs do not have all the corrections introduced into the bulk processed images produced by NDPF.

The major distortion is an enlargement of the image in the scanning direction (East-West approximately) and results from unequal sample spacing in the scanning and raster directions. Successive line spacing is larger than the spacing of successive samples along a line. Consequently, for a given linear dimension on the earth's surface, there are more samples along a scan line than normal to the raster (the scan line). Hence, the resolution could effectively be higher along the scanning direction.

The larger number of samples along the scan lines is actually a detriment to the spatial pattern recognition algorithms, and it is necessary to interpolate and resample the data along the scan lines so that each line contains fewer samples. Each ERTS-1 image is recorded on four tapes and each tape has 810 samples per line and 2,340 lines. The samples per line were reduced from 810 to 585 samples.

The interpolation is done most accurately by Fourier techniques. The Fourier transform of a line is taken and higher frequencies due to the larger number of samples are eliminated. The inverse Fourier transformation produces a line with 585 samples accurately interpolated. The only drawback of this technique is that it is inefficient in terms of computer time. Less accurate but faster interpolation techniques utilize polynomial interpolation such that each new sample is computed from a small number of original samples to which a polynomial is fitted. In any case, the data has been resampled and tested to verify the accuracy of the conversion. The resampled images were recorded and the major distortion in the scanning direction has been removed. However, a month was lost in doing this conversion and the resource interpretation has been delayed by a month.

A smaller distortion due to the earth's rotation is still present in the data. The corrected NDPF images are parallelograms (slightly skewed rectangles) because of the earth's rotation in relation to the satellite velocity. The uncorrected images are rectangular so the ground images are slightly skewed (approximately in an East-West direction) from their true shape. It is thought that this distortion will not affect the spatial pattern recognition algorithms and will not be corrected for the time being.

The images that have been resampled are now being processed through three different classification software systems:

1. A spatial terrain classification system.
2. A multispectral resource classification system.
3. A boundary and regionalized terrain classification system.

During the reporting period, work also continued on the development of spatial terrain signatures from diffraction patterns of ERTS-1 images. The results of this investigation are described in a report which has been written and will be printed shortly. Work was also done on several other reports.